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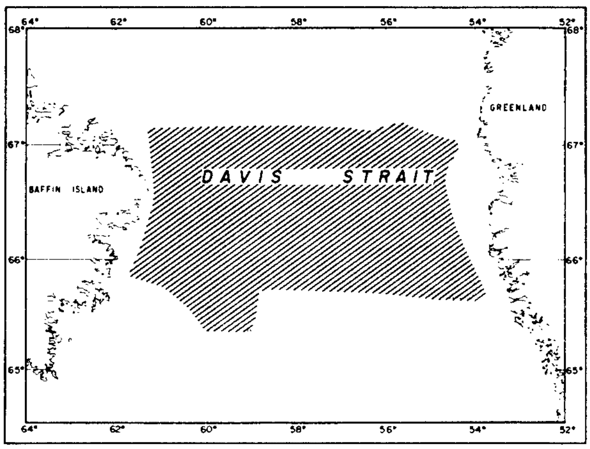
IR NO. 68-117

INFORMAL REPORT

OCEANOGRAPHIC CRUISE SUMMARY
DAVIS STRAIT
JULY-AUGUST 1968



DECEMBER 1968

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NAVAL OCEANOGRAPHIC OFFICE
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INFORMAL REPORT

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ABSTRACT

The Naval Oceanographic Office and USCGC WESTWIND (WAGB 283) conducted an oceanographic survey of the Davis Strait area during July and August of 1968.

In the western and central portions of Davis Strait, temperatures were found to increase and salinities were found to decrease from July to August. In the southeastern portion of Davis Strait, temperatures were lower in August.

The major core of the Baffin Land Current existed at 75 to 100 meters depth and did not extend as far east in August as in July. The core of the West Greenland Current occurred at depths below 300 meters.

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Nearshore Surveys Division
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L. B. Berthold

L. B. BERTHOLF
Director, Nearshore Surveys Division

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I. PREVIOUS KNOWLEDGE OF THE REGION

Outflow from the Arctic Ocean controls the water movement within the Baffin Bay-Davis Strait-Labrador Sea area.

The main outflow from the Arctic Ocean is the cold, low salinity East Greenland Current which flows south along the East Greenland Shelf. The water of this current continues through Denmark Strait, is modified by the warmer Irminger Current, rounds the southern tip of Greenland, and flows northwest along the west coast of Greenland as the West Greenland Current. Further warming takes place by mixing with other waters of the Labrador Sea. As the West Greenland Current flows northwest along Greenland, it encounters the Davis Strait Ridge. Here, the greatest part of the current is deflected westward from the shelf, thus forming a counterclockwise circulation in the Labrador Sea. The largest decrease in the northward transport of the West Greenland Current occurs between Holsteinborg and Godthaab, Greenland. The remainder of the West Greenland Current flows into Baffin Bay through the eastern half of Davis Strait.

Outflow from the Arctic Ocean also occurs through Lancaster, Jones, and Smith Sounds. This cold, low salinity water flows southeasterly along Baffin Island as the strong Baffin Land Current. This water also encounters the Davis Strait Ridge, and a part deflects to the east, thus creating with the West Greenland Current a counterclockwise circulation in Baffin Bay. The remainder of the Baffin Land Current flows through the western half of Davis Strait into the Labrador Sea.

As the West Greenland and Baffin Land Currents flow through Davis Strait, they can be distinguished easily by their large temperature difference.

II. OBJECTIVES OF THE CRUISE

The Naval Oceanographic Office (NAVOCEANO) and USCGC WESTWIND (WAGB 283) conducted an oceanographic survey in the Davis Strait area during the summer of 1968 (operation number 929004). The purpose of this survey was to study the mass transports and fluctuations of the Baffin Land and the West Greenland Currents across Davis Strait through direct current measurements. Additionally, temperature, salinity, and nutrient data were to be collected. The oceanographic stations were to be reoccupied to study the time variability of the parameters.

III. NARRATIVE OF THE CRUISE

Four oceanographers from NAVOCEANO boarded WESTWIND in Curtis Bay, Maryland, on 7 July 1968. On 21 July, the oceanographers began the implantation of seven subsurface current meter arrays. During the period 22 July to 1 August, 64 Nansen stations were completed. Fifty-four of these stations were reoccupied between 17 and 24 August.

The current meter arrays were retrieved between 24 and 27 August; five of the seven arrays were recovered. NAVOCEANO personnel departed WESTWIND on 31 August in Thule, Greenland.

Figure 1 presents the oceanographic station and current meter locations. Table I presents a summary of the data collected on each consecutive oceanographic station.

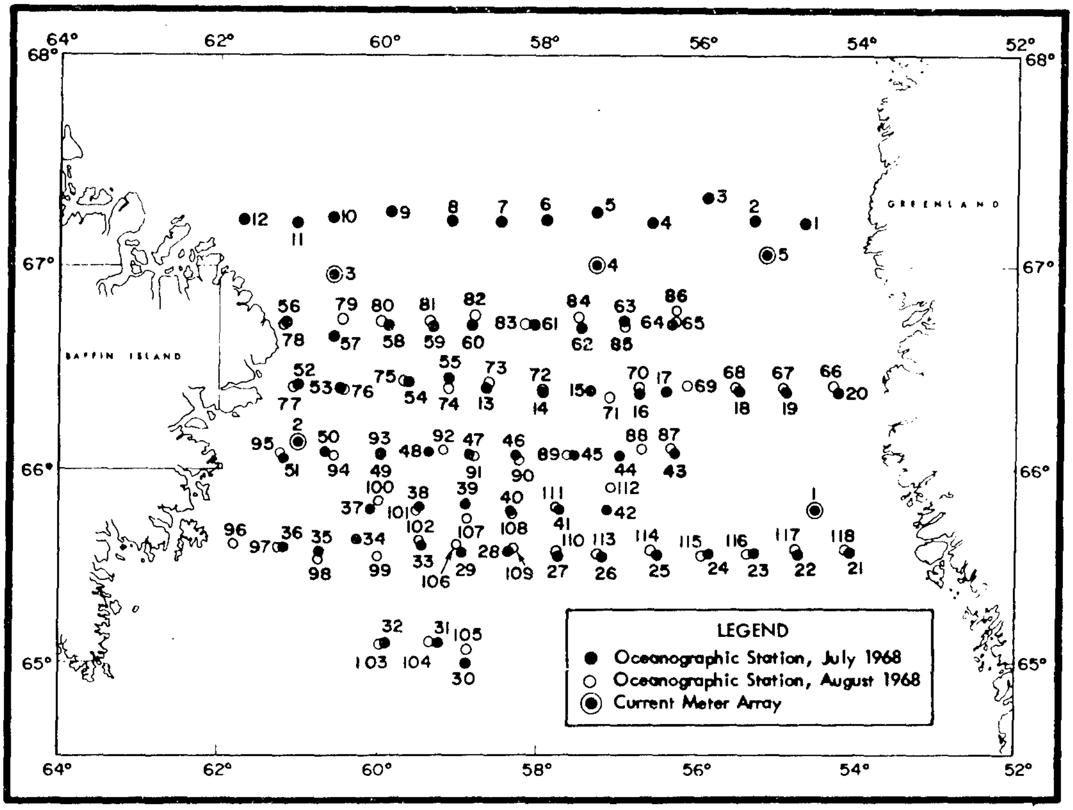

Figure 1. Oceanographic Station and Current Meter Locations.

IV. METHODS OF COLLECTION AND ANALYSIS

A. Physical Oceanography.

1. Temperature. Water temperatures were measured at selected depths with paired deep sea reversing thermometers attached to Nansen bottles. The accepted temperature values were obtained by applying standard corrections and averaging the two readings if the values differed by 0.05°C or less. When paired thermometers differed by more than 0.05°C, the reading from the thermometer considered more reliable, based on its previous performance, was used. Temperatures are considered accurate to ±0.02°C.

Coast Guard personnel conducted a bathythermograph (BT) program during the course of the survey. BT's were taken at every station and at 6-hour intervals while underway.

TABLE I. Oceanographic Station Data Collection Summary.

Station Number	Latitude °N	Longitude °W	Sonic Depth (Meters)	Cast Depth (Meters)	Temp/Sal	Nutrients
1	67°13'	54°41'	50	45	✓	✓
2	67°14'	55°18'	85	75	✓	✓
3	67°20'	55°55'	140	125	✓	✓
4	67°13'	56°35'	270	242	✓	✓
5	67°16'	57°17'	505	447	✓	✓
6	67°13'	57°55'	870	829	✓	✓
7	67°13'	58°30'	1280	979	✓	✓
8	67°13'	59°07'	1426	1200	✓	✓
9	67°15'	59°52'	1353	1264	✓	✓
10	67°14'	60°35.5'	1070	995	✓	✓
11	67°12.4'	61°02'	624	564	✓	✓
12	67°13'	61°43'	201	200	✓	✓
13	66°25'	58°38'	677	601	✓	✓
14	66°23'	57°56'	576	424	✓	✓
15	66°24'	57°20.2'	640	448	✓	✓
16	66°23'	56°44'	585	489	✓	✓
17	66°24'	56°24'	183	164	✓	✓
18	66°24'	55°29'	218	193	✓	✓
19	66°24'	54°54'	329	241	✓	✓
20	66°24'	54°15.5'	53	45	✓	✓
21	65°35'	54°05'	110	88	✓	✓
22	65°35'	54°44'	115	118	✓	✓
23	65°34.5'	55°17.5'	402	416	✓	✓
24	65°34'	55°52'	754	712	✓	✓
25	65°34'	56°30'	741	664	✓	✓
26	65°33'	57°12'	677	526	✓	✓
27	65°34'	57°45.5'	622	460	✓	✓
28	65°35'	58°19'	545	501	✓	✓
29	65°35'	58°56'	507	390	✓	✓
30	65°00'	58°53'	500	424	✓	✓
31	65°06'	59°14'	512	433	✓	✓
32	65°06'	59°54'	448	396	✓	✓
33	65°37'	59°28'	567	487	✓	✓
34	65°38'	60°16'	466	397	✓	✓
35	65°34'	60°44'	370	324	✓	✓
36	65°36'	61°12'	310	288	✓	✓
37	65°48'	60°04'	530	350	✓	✓
38	65°48'	59°29'	622	579	✓	✓
39	65°49'	58°54'	535	497	✓	✓
40	65°47'	58°19'	574	496	✓	✓
41	65°47.8'	57°44'	622	540	✓	✓
42	65°48'	57°08'	704	608	✓	✓
43	66°06'	56°18'	180	175	✓	✓
44	66°04'	56°58'	595	584	✓	✓
45	66°04'	57°33'	575	479	✓	✓
46	66°04.2'	58°17'	658	539	✓	✓
47	66°04.2'	58°51'	630	488	✓	✓
48	66°05'	59°22'	691	574	✓	✓
49	66°04'	59°57'	585	515	✓	✓
50	66°05'	60°40.5'	395	399	✓	✓
51	66°04'	61°12'	185	175	✓	✓
52	66°24.5'	61°01'	290	249	✓	✓
53	66°24'	60°28'	440	345	✓	✓
54	66°26.5'	59°38.3'	783	750	✓	✓
55	66°27'	59°08'	753	692	✓	✓
56	66°44'	61°11'	120	99	✓	✓
57	66°40'	60°33'	549	331	✓	✓
58	66°42.9'	59°55'	732	643	✓	✓
59	66°43'	59°20'	860	900	✓	✓
60	66°43'	58°51'	730	684	✓	✓
61	66°43'	58°03.5'	605	600	✓	✓
62	66°42.2'	57°28.5'	741	694	✓	✓
63	66°44'	56°55'	614	548	✓	✓
64	66°44'	56°20'	164	141	✓	✓
65	66°44'	56°18'	175	160	✓	
66	66°25'	54°17'	53	45	✓	
67	66°24'	59°54.5'	370	313	✓	✓
68	66°24'	55°30'	210	200	✓	
69	66°24.7'	56°07.5'	175	160	✓	
70	66°24'	56°44'	539	500	✓	
71	66°22'	57°16'	585	538	✓	
72	66°23'	57°56'	580	555	✓	
73	66°26'	58°36'	677	597	✓	
74	66°24'	59°08'	777	682	✓	✓
75	66°26'	59°40'	761	624	✓	
76	66°23'	60°25'	457	433	✓	
77	66°24'	61°02'	210	188	✓	
78	66°43'	61°10'	183	169	✓	
79	66°44'	60°27'	549	475	✓	✓
80	66°43.2'	59°56.5'	750	663	✓	
81	66°44'	59°21'	969	700	✓	
82	66°45.2'	58°47.8'	905	863	✓	
83	66°43'	58°08'	655	600	✓	
84	66°45'	57°30'	722	682	✓	
85	66°43.5'	56°54.5'	640	592	✓	✓
86	66°47'	56°16'	185	175	✓	
87	66°06'	56°19'	192	175	✓	
88	66°06'	56°41'	603	575	✓	
89	66°04'	57°36'	606	569	✓	
90	66°02.6'	58°11.5'	631	594	✓	
91	66°04.2'	58°48'	603	575	✓	
92	66°05.5'	59°10.3'	686	650	✓	
93	66°04'	59°57.5'	549	500	✓	✓
94	66°04'	60°32'	411	400	✓	
95	66°04'	61°12'	192	175	✓	
96	65°37'	61°47'	210	200	✓	
97	65°36'	61°13'	302	275	✓	
98	65°32'	60°43'	353	325	✓	
99	65°33'	59°58'	475	463	✓	
100	65°49.5'	59°59.5'	520	484	✓	
101	65°47.2'	59°30'	603	575	✓	
102	65°38'	59°28'	554	500	✓	
103	65°05'	59°55'	430	392	✓	
104	65°06'	59°19'	460	425	✓	
105	65°04'	58°51'	483	450	✓	
106	65°36.2'	58°59.5'	475	353	✓	
107	65°45'	58°52'	567	532	✓	
108	65°46'	58°18'	554	436	✓	
109	65°35'	58°18'	524	442	✓	
110	65°35'	57°45.5'	600	461	✓	
111	65°48'	57°44'	585	568	✓	
112	65°54'	57°04'	677	650	✓	
113	65°34'	57°14'	644	635	✓	
114	65°35'	56°34'	695	563	✓	
115	65°33.5'	55°55.2'	732	733	✓	
116	65°35'	55°21'	365	289	✓	
117	65°35.5'	54°44.5'	107	97	✓	
118	65°35.1'	54°05.5'	107	90	✓	

2. Depth. Thermometric depth data from unprotected reversing thermometers, meter wheel readings, and wire angle measurements were used to determine sampling depths.

3. Currents. Current measurements were obtained using Geodyne model A-101 self-contained current meters. The current meters were moored on arrays by utilizing 500-pound net buoyancy subsurface floats. In addition to the subsurface float, each array (Fig. 2) consisted of 9/16-inch braided nylon mooring line, two Geodyne model 855 timed-release mechanisms, a damping plate, three 450-pound anchor clumps, and one to three current meters, depending on the location. The current meters were preset to record current speed and direction for a 50-second period every 10 or 15 minutes, depending on the meter. The

damping plate was used to slow the descent of the array upon implantation. When the release mechanisms actuated, the subsurface buoy, with the attached current meters and release mechanisms, raised to the surface. The damping plate and anchor remained on the bottom.

Table II lists the position, number of current meters, and number of hourly recordings per meter for each array.

TABLE II. Current Meter Data Collection Summary.

Array No.*	Latitude °N	Longitude °W	No. of Meters	No. of Recordings per hr. per Meter
1	65°48.0'	54°31.5'	1	4
6	65°48.8'	56°56.5'	2	4
2	66°07.6'	61°00.0'	1	6
7	66°24.6'	58°38.5'	3	6
3	66°57.0'	60°34.0'	1	6
4	67°00.5'	57°17.2'	2	4
5	67°02.6'	55°10.3'	1	4

*Arrays 6 and 7 were not recovered

B. Chemical Oceanography.

1. Salinity. Salinity samples were analyzed aboard ship using a portable Hytech induction salinometer. With this instrument, salinity can be measured with a precision of ± 0.003 ‰. Samples from a previously determined station were rerun to check the precision of the instrument. Salinity values presented in this report are considered accurate to well within 0.02 ‰ .

2. Micronutrients. Water samples for micronutrient analyses were drawn into 6-ounce polyethylene bottles, quick frozen, and stored in the ship's freezer. The samples were returned to NAVOCEANO to be analyzed for reactive phosphorous in accordance with the method described by Murphy and Riley in 1962, "Determination of Phosphates in Natural Sea Water," and for reactive silicate and nitrate following the method described by Strickland and Parsons in 1965, "A Manual of Sea Water Analyses."

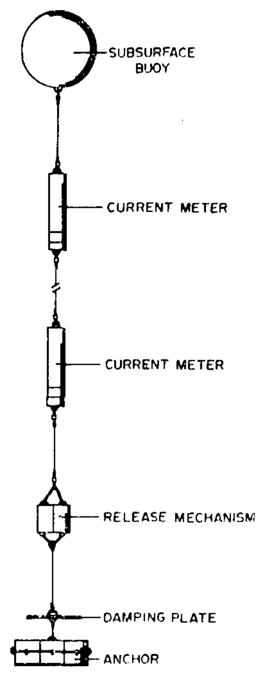

Figure 2. Current Meter Array.

V. DISPOSITION OF DATA

All serial-depth temperature and salinity data will be forwarded to the National Oceanographic Data Center (NODC) where computer computations will provide listings of temperature, salinity, sound velocity, density (sigma-t), and dynamic depth and specific volume anomalies at standard depths. When nutrient analyses have been completed, the results will be forwarded to NODC for inclusion on the listings. The current observations will be analyzed by and held on file at NAVOCEANO. All BT data will be made available by the Coast Guard through NODC.

VI. PRELIMINARY ANALYSES

The West Greenland Current, which basically follows the West Greenland Slope, consists of two water masses: Arctic Water from the East Greenland Current and Atlantic Water from the Irminger Current and Labrador Sea. Due to changes that may occur in the North Atlantic area, the West Greenland Current is subject to considerable variations in temperature.

The Baffin Land Current consists of Arctic Water from Lancaster, Jones, and Smith Sounds and from waters of Baffin Bay which are modified by the mixing of Arctic Water with the waters of the West Greenland Current. The core of the Baffin Land Current (water less than -1.5°C) follows the Baffin Land Slope.

Horizontal temperature and salinity cross sections (Figs. 3 to 6) were drawn at 0- and 100-meter depths for stations occupied in July and the stations that were reoccupied in August. During this time interval, temperatures in the western and central portions of Davis Strait increased and salinities decreased. The temperature increase was accompanied by an increase in the gradient. The salinity decrease probably was due to glacial runoff from Baffin Island. In the southeastern portion of Davis Strait, temperatures were cooler in August. This decrease may have been due to increased glacial runoff from Greenland or from changes in the circulation patterns.

The vertical east-west cross sections (Figs. 7 and 8) show an eastward flooding of the Baffin Land Current as it overrides the warm West Greenland Current from the south. The major core of the Baffin Land Current existed at 75 to 100 meters. The core did not extend as far east in August as in July.

The southernmost cross section (Fig. 7) portrays the core of the West Greenland Current (>4°C) at depths below 300 meters over the Greenland Slope. This water, the warmest and most saline observed on the survey, is derived from the Irminger Current and from waters of the Labrador Sea. At the northernmost cross section (Fig. 8), the core of the West Greenland Current was observed in July; intermixing with the Baffin Land Current, however, caused lower temperatures, and the core was not observed in August.

VII. ADDITIONAL WORK NEEDED IN THE REGION

The majority of oceanographic data collected in Davis Strait have been for the summer months only. Oceanography during the winter months is relatively unknown due to the severe ice conditions. Efforts should be made to collect oceanographic data during the winter months.

Davis Strait data contribute only to one aspect of the overall Arctic outflow. Therefore, current measurements and water samples should also be obtained simultaneously at five other areas: Denmark Strait, Hudson Strait, Smith Sound, Jones Sound, and Lancaster Sound. Measurements in Denmark Strait and the three sounds should be started several months before observations are made in Davis Strait. In this way, a correlation might be achieved.

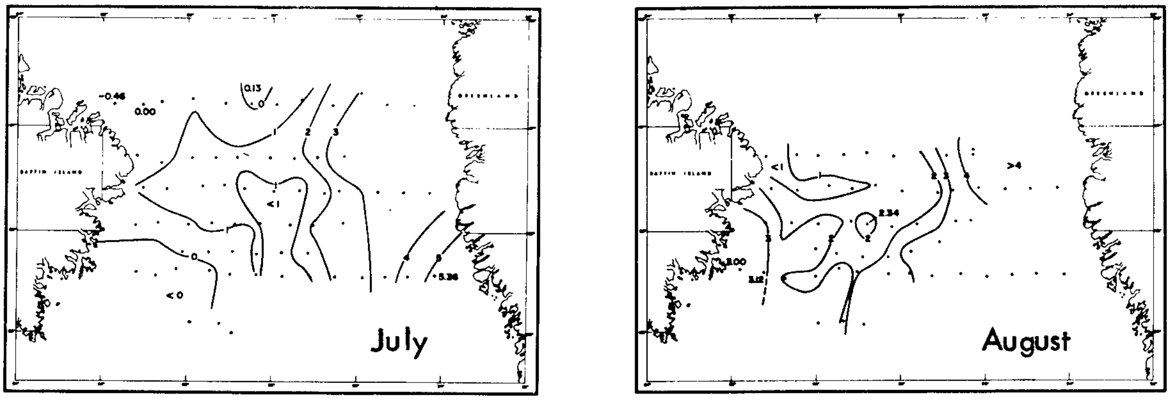

Figure 3. Surface Horizontal Temperature Distributions For July and August.

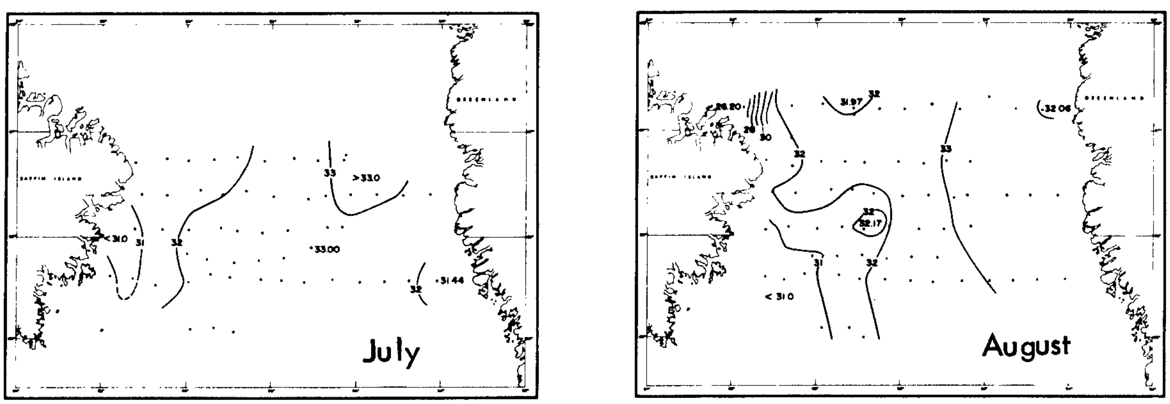

Figure 4. Surface Horizontal Salinity Distributions For July and August.

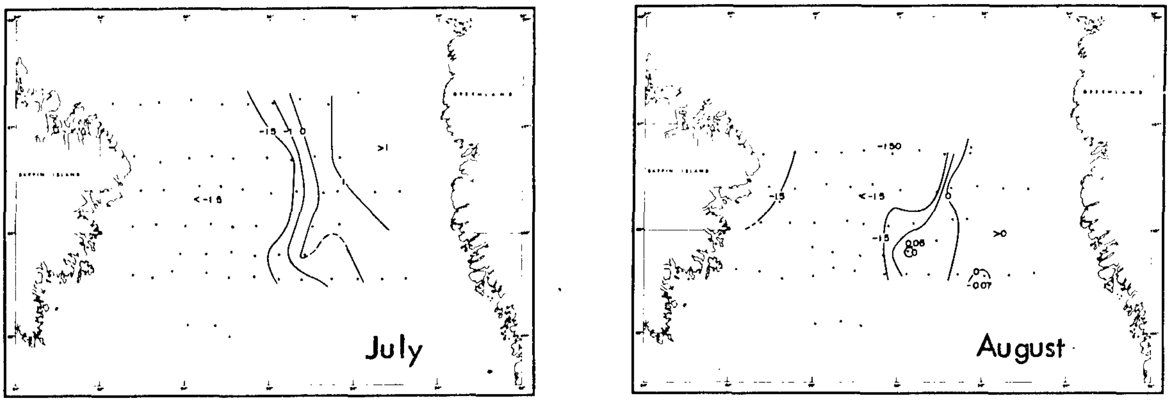

Figure 5. Horizontal Temperature Distributions at 100 Meters For July and August.

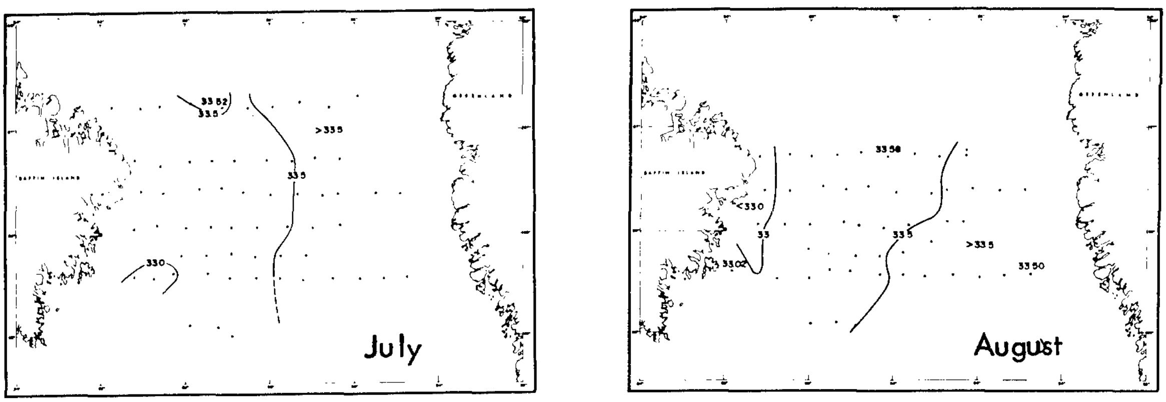

Figure 6. Horizontal Salinity Distributions at 100 Meters For July and August.

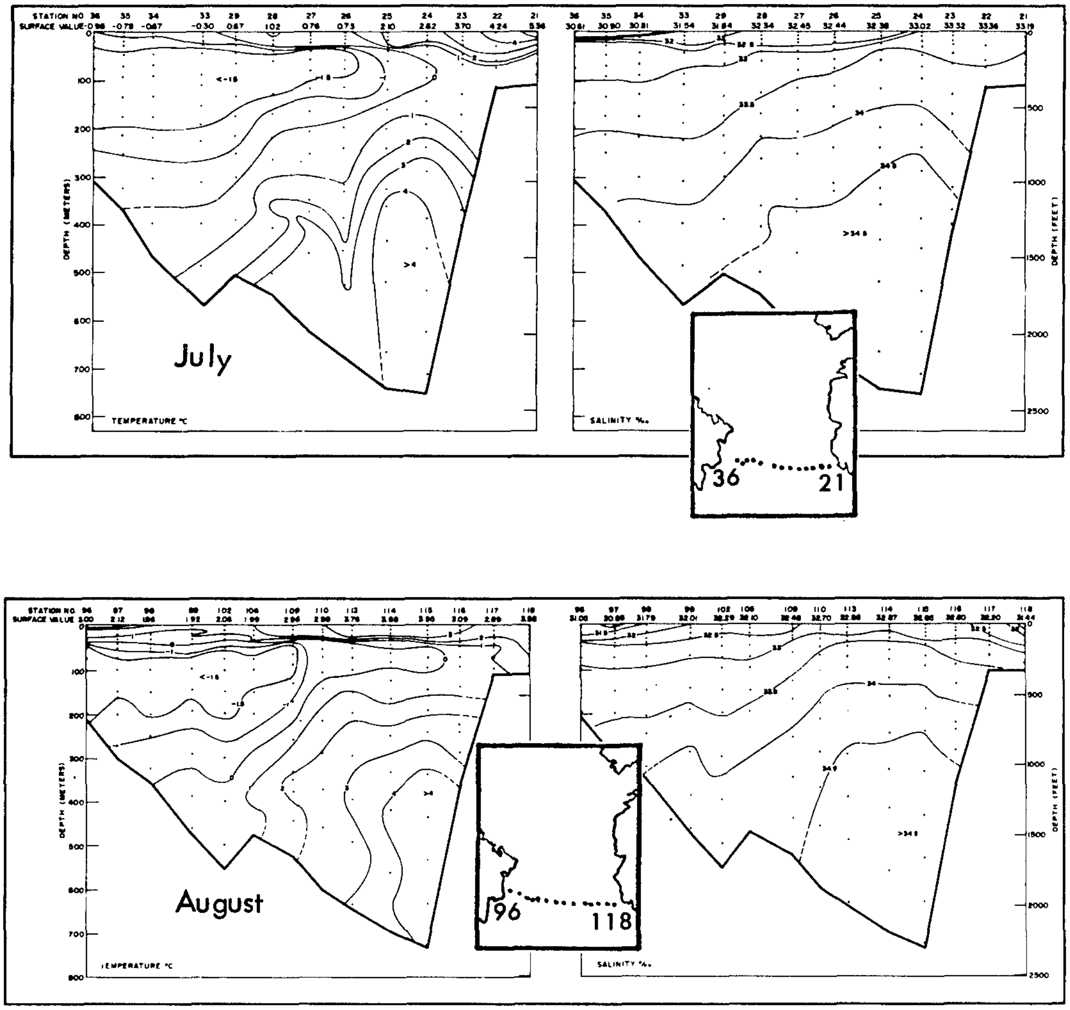

Figure 7. Southernmost Vertical Cross Sections For July and August.

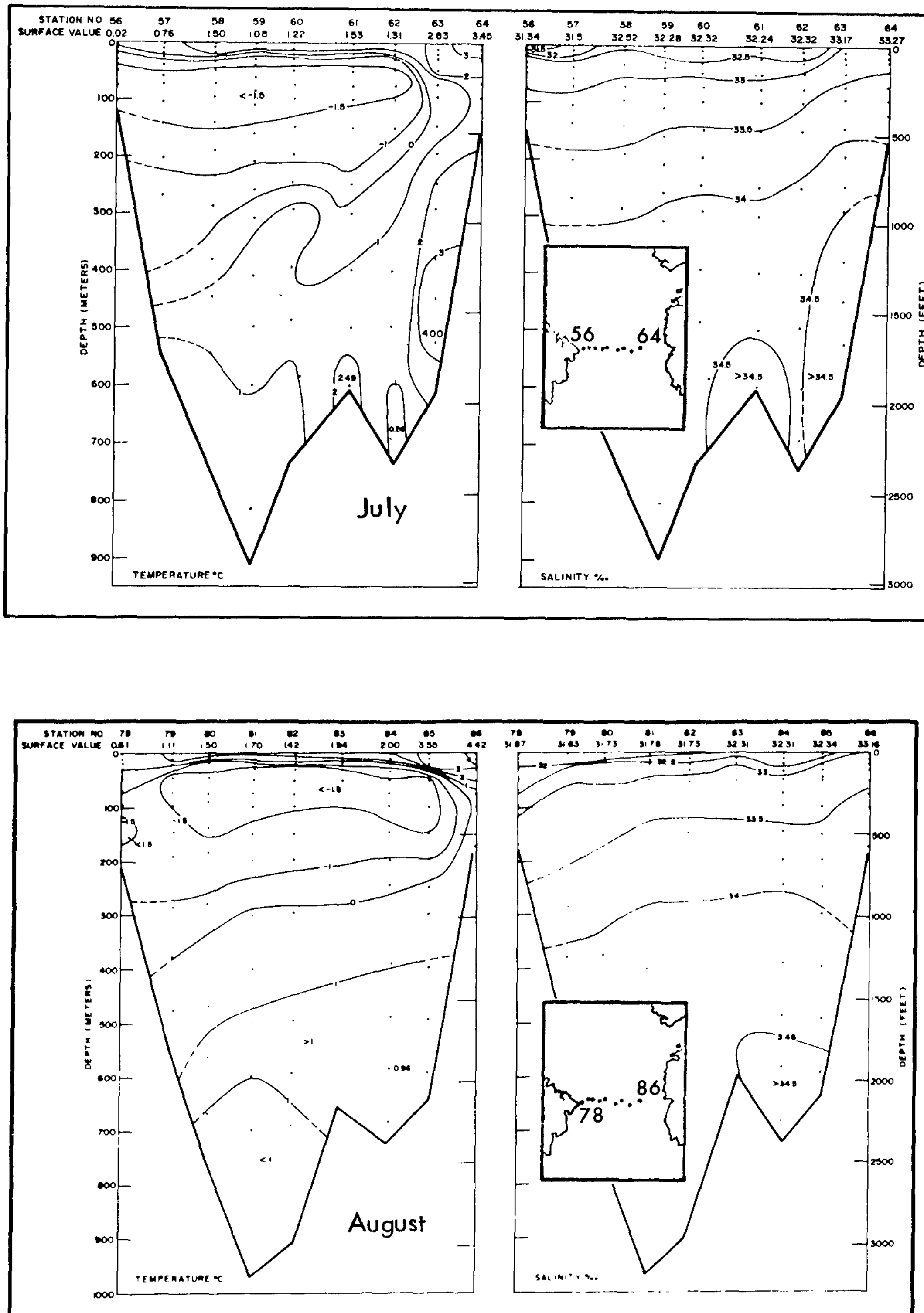

Figure 8. Northernmost Vertical Cross Sections For July and August.

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13. ABSTRACT

The Naval Oceanographic Office and USCGC WESTWIND (WAGB 283) conducted an oceanographic survey of the Davis Strait area during July and August of 1968.

In the western and central portions of Davis Strait, temperatures were found to increase and salinities were found to decrease from July to August. In the southeastern portion of Davis Strait, temperatures were lower in August.

The major core of the Baffin Land Current existed at 75 to 100 meters depth and did not extend as far east in August as in July. The core of the West Greenland Current occurred at depths below 300 meters.

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14. KEY WORDS	LINK A		LINK B		LINK C	
	ROLE	WT	ROLE	WT	ROLE	WT
DAVIS STRAIT						
BAFFIN BAY						
LABRADOR SEA						
BAFFIN LAND CURRENT						
WEST GREENLAND CURRENT						
USCGC WESTWIND (WAGB 283)						

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